SEQUENCE LISTING

<110> KUWABARA, Yoko
HASHIGUCHI, Kenichi
NAKAMATSU, Tsuyoshi
KURAHASHI, Osamu
MORI, Yukiko
ITO, Hisao

<120> CARBAMOYL-PHOSPHATE SYNTHETASE GENE OF CORYNEFORM BACTERIA AND METHOD FOR PRODUCING L-ARGININE

<130> OP945CIP

<141> 2000- -

<160> 7

<170> PatentIn Ver. 2.0

<210> 1
<211> 4837
<212> DNA
<213> Brevibacterium lactofermentum

<220>
<221> CDS
<222> (283)..(1461)

<220>
<221> CDS
<222> (1470)..(4808)

<400> 1
gatccaggaa aaacctggac agcatccggt gcagactttg cgtccaaggc tgaaaacacc 60
ccatttgagg gccaggaatt cagcgctaag gtcacacaca ccgtgcttcg tggcaaggtg 120
acttgtgcag acggagttgc gcaagacgct taacgggtgg gtgcatagta tgcacgcgcc 180
gcattgcata taatgcaatg aattgaataa actacattca gggttatcaa ccagccaatt 240
tcttttaaaa agacagacac acgaaaggcg acaacagtca cc gtg agt aaa gac 294

```
                                                    Val Ser Lys Asp
                                                     1
acc acc acc tac cag gga gtc acc gag atc gga tcc gtt ccg gca tac   342
Thr Thr Thr Tyr Gln Gly Val Thr Glu Ile Gly Ser Val Pro Ala Tyr
 5                  10                  15                  20
ctg gtt ctt gca gac gga cgt acc ttc acc gga ttt ggc ttt gga gct   390
Leu Val Leu Ala Asp Gly Arg Thr Phe Thr Gly Phe Gly Phe Gly Ala
                25                  30                  35
atc ggc acc acc ctt ggt gag gca gtg ttc acc acc gcc atg acc ggt   438
Ile Gly Thr Thr Leu Gly Glu Ala Val Phe Thr Thr Ala Met Thr Gly
            40                  45                  50
tac caa gaa acc atg acc gat cct tcc tat cac cgc cag att gtt gtg   486
Tyr Gln Glu Thr Met Thr Asp Pro Ser Tyr His Arg Gln Ile Val Val
        55                  60                  65
gct acc gca cca cag atc ggt aac acc ggc tgg aac gat gag gac aac   534
Ala Thr Ala Pro Gln Ile Gly Asn Thr Gly Trp Asn Asp Glu Asp Asn
    70                  75                  80
gag tcc cgc gac ggc aag att tgg gtt gca ggc ctt gtt atc cgc gac   582
Glu Ser Arg Asp Gly Lys Ile Trp Val Ala Gly Leu Val Ile Arg Asp
 85                  90                  95                 100
ctc gca gca cgt gtg tcc aac tgg cgc gcc acc acc tcc ttg cag cag   630
Leu Ala Ala Arg Val Ser Asn Trp Arg Ala Thr Thr Ser Leu Gln Gln
                105                 110                 115
gaa atg gca gac caa ggc atc gtc ggc atc ggc gga atc gac acc cgc   678
Glu Met Ala Asp Gln Gly Ile Val Gly Ile Gly Gly Ile Asp Thr Arg
            120                 125                 130
gca ctg gtt cgc cac ctg cgc aac gaa ggt tcc atc gca gcg ggc atc   726
Ala Leu Val Arg His Leu Arg Asn Glu Gly Ser Ile Ala Ala Gly Ile
        135                 140                 145
ttc tcc ggc gct gac gca cag cgc cca gtt gaa gaa ctc gta gag atc   774
Phe Ser Gly Ala Asp Ala Gln Arg Pro Val Glu Glu Leu Val Glu Ile
    150                 155                 160
gtc aag aat cag cca gca atg acc ggc gca aac ctc tcc gtt gag gtc   822
Val Lys Asn Gln Pro Ala Met Thr Gly Ala Asn Leu Ser Val Glu Val
165                 170                 175                 180
tct gct gat gaa acc tac gtc atc gaa gct gag ggc gaa gag cgc cac   870
Ser Ala Asp Glu Thr Tyr Val Ile Glu Ala Glu Gly Glu Glu Arg His
                185                 190                 195
acc gtc gtg gcc tac gac ctg ggc att aag caa aac acc cca cgt cgt   918
Thr Val Val Ala Tyr Asp Leu Gly Ile Lys Gln Asn Thr Pro Arg Arg
            200                 205                 210
```

```
ttc tct gca cgc ggt gtt cgc acc gtc atc gtg cct gct gaa acc cca   966
Phe Ser Ala Arg Gly Val Arg Thr Val Ile Val Pro Ala Glu Thr Pro
        215                 220                 225
ttg gag gac atc aag cag tac aac cca tca ggc gtg ttt atc tcc aat  1014
Leu Glu Asp Ile Lys Gln Tyr Asn Pro Ser Gly Val Phe Ile Ser Asn
    230                 235                 240
ggc cct ggc gac cct gca gca gca gac gtc atg gtt gat atc gtc cgc  1062
Gly Pro Gly Asp Pro Ala Ala Ala Asp Val Met Val Asp Ile Val Arg
245                 250                 255                 260
gaa gtt ctg gaa gcc gac att cca ttc ttt ggc atc tgc ttc ggc aac  1110
Glu Val Leu Glu Ala Asp Ile Pro Phe Phe Gly Ile Cys Phe Gly Asn
                265                 270                 275
cag atc ctc ggc cgc gca ttc ggc atg gag acc tac aag ctg aag ttc  1158
Gln Ile Leu Gly Arg Ala Phe Gly Met Glu Thr Tyr Lys Leu Lys Phe
            280                 285                 290
ggc cac cgc ggc atc aac gtt cca gtg aag aac cac atc acc ggc aag  1206
Gly His Arg Gly Ile Asn Val Pro Val Lys Asn His Ile Thr Gly Lys
        295                 300                 305
atc gac atc acc gcc cag aac cac ggc ttc gca ctc aag ggt gaa gca  1254
Ile Asp Ile Thr Ala Gln Asn His Gly Phe Ala Leu Lys Gly Glu Ala
    310                 315                 320
ggc cag gaa ttc gag aca gat ttc ggc act gcg att gtc acc cac acc  1302
Gly Gln Glu Phe Glu Thr Asp Phe Gly Thr Ala Ile Val Thr His Thr
325                 330                 335                 340
tgc ctt aac gac ggc gtc gtt gaa ggt gtt gcg ctg aag tcc gga cgc  1350
Cys Leu Asn Asp Gly Val Val Glu Gly Val Ala Leu Lys Ser Gly Arg
                345                 350                 355
gca tac tcc gtt cag tac cac cca gag gcc gct gcc ggc cca aat gat  1398
Ala Tyr Ser Val Gln Tyr His Pro Glu Ala Ala Ala Gly Pro Asn Asp
            360                 365                 370
gca agc ccc ctg ttt gac cag ttt gtt gag ctg atg gat gca gac gct  1446
Ala Ser Pro Leu Phe Asp Gln Phe Val Glu Leu Met Asp Ala Asp Ala
        375                 380                 385
cag aag aaa ggc gca taaataac atg cca aag cgt tca gat att aac cac  1496
Gln Lys Lys Gly Ala          Met Pro Lys Arg Ser Asp Ile Asn His
    390                       1               5
gtc ctc gtc atc ggt tcc ggc ccc atc gtc att ggc cag gca tgt gaa   1544
Val Leu Val Ile Gly Ser Gly Pro Ile Val Ile Gly Gln Ala Cys Glu
 10                  15                  20                  25
ttc gac tac tcc ggc acc cag gct tgc cgc gtg ctg aag gaa gag gga   1592
Phe Asp Tyr Ser Gly Thr Gln Ala Cys Arg Val Leu Lys Glu Glu Gly
```

```
                30                  35                  40
ctg cgc gtc acc ctc atc aac tcc aac cca gca acg atc atg acc gac   1640
Leu Arg Val Thr Leu Ile Asn Ser Asn Pro Ala Thr Ile Met Thr Asp
            45                  50                  55
cca gaa atg gct gac cac acc tac gtg gag cca atc gag ccg gaa tac   1688
Pro Glu Met Ala Asp His Thr Tyr Val Glu Pro Ile Glu Pro Glu Tyr
        60                  65                  70
atc gac aag att ttc gct aag gag atc gag cag ggc cac cca atc gac   1736
Ile Asp Lys Ile Phe Ala Lys Glu Ile Glu Gln Gly His Pro Ile Asp
    75                  80                  85
gcc gtc ctg gca acc ctt ggt ggc cag act gca ctt aac gca gct atc   1784
Ala Val Leu Ala Thr Leu Gly Gly Gln Thr Ala Leu Asn Ala Ala Ile
 90                  95                 100                 105
cag ctg gat cgc ctc ggc atc ctg gaa aag tac ggc gtt gaa ctc atc   1832
Gln Leu Asp Arg Leu Gly Ile Leu Glu Lys Tyr Gly Val Glu Leu Ile
                110                 115                 120
ggt gca gac atc gat gcc att gag cgc ggc gaa gat cgc cag aag ttc   1880
Gly Ala Asp Ile Asp Ala Ile Glu Arg Gly Glu Asp Arg Gln Lys Phe
            125                 130                 135
aag gat att gtc acc acc atc ggt ggc gaa tcc gcg cgt tcc cgc gtc   1928
Lys Asp Ile Val Thr Thr Ile Gly Gly Glu Ser Ala Arg Ser Arg Val
        140                 145                 150
tgc cac aac atg gac gaa gtc cat gag act gtc gca gaa ctt ggc ctt   1976
Cys His Asn Met Asp Glu Val His Glu Thr Val Ala Glu Leu Gly Leu
    155                 160                 165
cca gta gtc gtg cgt cca tcc ttc act atg ggt ggc ctg ggc tcc ggt   2024
Pro Val Val Val Arg Pro Ser Phe Thr Met Gly Gly Leu Gly Ser Gly
170                 175                 180                 185
ctt gca tac aac acc gaa gac ctt gag cgc atc gca ggt ggc gga ctt   2072
Leu Ala Tyr Asn Thr Glu Asp Leu Glu Arg Ile Ala Gly Gly Gly Leu
                190                 195                 200
gct gca tct cct gaa gca aac gtc ttg atc gaa gaa tcc atc ctt ggt   2120
Ala Ala Ser Pro Glu Ala Asn Val Leu Ile Glu Glu Ser Ile Leu Gly
            205                 210                 215
tgg aag gaa ttc gag ctc gag ctc atg cgc gat acc gca gac aac gtt   2168
Trp Lys Glu Phe Glu Leu Glu Leu Met Arg Asp Thr Ala Asp Asn Val
        220                 225                 230
gtg gtt atc tgc tcc att gaa aac gtc gac gca ctg ggc gtg cac acc   2216
Val Val Ile Cys Ser Ile Glu Asn Val Asp Ala Leu Gly Val His Thr
    235                 240                 245
ggc gac tct gtc acc gtg gca cct gcc ctg acc ctg act gac cgt gaa   2264
```

Gly Asp Ser Val Thr Val Ala Pro Ala Leu Thr Leu Thr Asp Arg Glu
250 255 260 265
ttc cag aag atg cgc gat cag ggt atc gcc atc atc cgc gag gtc ggc 2312
Phe Gln Lys Met Arg Asp Gln Gly Ile Ala Ile Ile Arg Glu Val Gly
270 275 280
gtg gac acc ggt gga tgt aac atc cag ttc gct atc aac cca gtt gat 2360
Val Asp Thr Gly Gly Cys Asn Ile Gln Phe Ala Ile Asn Pro Val Asp
285 290 295
ggc cgc atc atc acc att gag atg aac cca cgt gtg tct cgt tcc tcc 2408
Gly Arg Ile Ile Thr Ile Glu Met Asn Pro Arg Val Ser Arg Ser Ser
300 305 310
gcg ctg gca tcc aag gca acg ggc ttc cca att gcc aag atg gct gcc 2456
Ala Leu Ala Ser Lys Ala Thr Gly Phe Pro Ile Ala Lys Met Ala Ala
315 320 325
aag ctg gct atc gga tac acc ctg gat gag atc acc aac gac atc act 2504
Lys Leu Ala Ile Gly Tyr Thr Leu Asp Glu Ile Thr Asn Asp Ile Thr
330 335 340 345
ggt gaa acc cca gct gcg ttt gag ccc acc atc gac tac gtc gtg gtc 2552
Gly Glu Thr Pro Ala Ala Phe Glu Pro Thr Ile Asp Tyr Val Val Val
350 355 360
aag gcc cca cgc ttt gct ttc gag aag ttt gtc ggc gct gat gac act 2600
Lys Ala Pro Arg Phe Ala Phe Glu Lys Phe Val Gly Ala Asp Asp Thr
365 370 375
ttg acc acc acc atg aag tcc gtc ggt gag gtc atg tcc ctg ggc cgt 2648
Leu Thr Thr Thr Met Lys Ser Val Gly Glu Val Met Ser Leu Gly Arg
380 385 390
aac tac att gca gca ctg aac aag gca ctg cgt tcc ctg gaa acc aag 2696
Asn Tyr Ile Ala Ala Leu Asn Lys Ala Leu Arg Ser Leu Glu Thr Lys
395 400 405
cag cag ggt ttc tgg acc aag cct gat gag ttc ttc gca ggg gag cgc 2744
Gln Gln Gly Phe Trp Thr Lys Pro Asp Glu Phe Phe Ala Gly Glu Arg
410 415 420 425
gct acc gat aag gca gct gtt ctg gaa gat ctc aag cgc cca acc gaa 2792
Ala Thr Asp Lys Ala Ala Val Leu Glu Asp Leu Lys Arg Pro Thr Glu
430 435 440
ggc cgc ctc tac gac gtt gag ctg gca atg cgc ctt ggc gca agc gtg 2840
Gly Arg Leu Tyr Asp Val Glu Leu Ala Met Arg Leu Gly Ala Ser Val
445 450 455
gaa gaa ctc tac gaa gca tct tct att gat cct tgg ttc ctc gcc gag 2888
Glu Glu Leu Tyr Glu Ala Ser Ser Ile Asp Pro Trp Phe Leu Ala Glu
460 465 470

```
ctt gaa gct ctc gtg cag ttc cgc cag aag ctc gtt gac gca cca ttc   2936
Leu Glu Ala Leu Val Gln Phe Arg Gln Lys Leu Val Asp Ala Pro Phe
    475                 480                 485
ctc aac gaa gat ctc ctg cgc gaa gca aag ttc atg ggt ctg tcc gac   2984
Leu Asn Glu Asp Leu Leu Arg Glu Ala Lys Phe Met Gly Leu Ser Asp
490                 495                 500                 505
ctg cag atc gca gcc ctt cgc cca gag ttc gct ggc gaa gac ggc gta   3032
Leu Gln Ile Ala Ala Leu Arg Pro Glu Phe Ala Gly Glu Asp Gly Val
                510                 515                 520
cgc acc ttg cgt ctg tcc cta ggc atc cgc cca gta ttc aag act gtg   3080
Arg Thr Leu Arg Leu Ser Leu Gly Ile Arg Pro Val Phe Lys Thr Val
            525                 530                 535
gat acc tgt gca gca gag ttt gaa gct aag act ccg tac cac tac tcc   3128
Asp Thr Cys Ala Ala Glu Phe Glu Ala Lys Thr Pro Tyr His Tyr Ser
        540                 545                 550
gca tac gag ctg gat cca gca gct gag tct gag gtc gca cca cag act   3176
Ala Tyr Glu Leu Asp Pro Ala Ala Glu Ser Glu Val Ala Pro Gln Thr
    555                 560                 565
gag cgt gaa aag gtc ctg atc ttg ggc tcc ggt cca aac cgc atc ggc   3224
Glu Arg Glu Lys Val Leu Ile Leu Gly Ser Gly Pro Asn Arg Ile Gly
570                 575                 580                 585
cag ggc atc gag ttc gac tat tcc tgt gtt cac gca gct ctt gag ctc   3272
Gln Gly Ile Glu Phe Asp Tyr Ser Cys Val His Ala Ala Leu Glu Leu
                590                 595                 600
tcc cgc gtc ggc tac gaa act gtc atg gtc aac tgc aac cca gag acc   3320
Ser Arg Val Gly Tyr Glu Thr Val Met Val Asn Cys Asn Pro Glu Thr
            605                 610                 615
gtg tcc acc gac tac gac acc gct gac cgc ctg tac ttc gag cca ctg   3368
Val Ser Thr Asp Tyr Asp Thr Ala Asp Arg Leu Tyr Phe Glu Pro Leu
        620                 625                 630
acc ttc gaa gac gtc atg gag gtc tac cac gct gag gcg cag tcc ggc   3416
Thr Phe Glu Asp Val Met Glu Val Tyr His Ala Glu Ala Gln Ser Gly
    635                 640                 645
acc gtc gca ggt gtt atc gtc cag ctt ggt ggc cag act cct ctg ggc   3464
Thr Val Ala Gly Val Ile Val Gln Leu Gly Gly Gln Thr Pro Leu Gly
650                 655                 660                 665
ttg gca gat cgt ttg aag aag gct ggc gtc cct gtc att ggt acc tcc   3512
Leu Ala Asp Arg Leu Lys Lys Ala Gly Val Pro Val Ile Gly Thr Ser
                670                 675                 680
cca gag gca atc gac atg gct gag gac cgt ggc gag ttc ggt gca ctg   3560
Pro Glu Ala Ile Asp Met Ala Glu Asp Arg Gly Glu Phe Gly Ala Leu
```

```
            685                 690                 695
ctg aac cgc gag cag ctt cct gct cca gca ttc ggc acc gca acc tct   3608
Leu Asn Arg Glu Gln Leu Pro Ala Pro Ala Phe Gly Thr Ala Thr Ser
        700                 705                 710
ttc gaa gag gct cgc aca gta gcc gat gag atc agc tac cca gtg ctg   3656
Phe Glu Glu Ala Arg Thr Val Ala Asp Glu Ile Ser Tyr Pro Val Leu
    715                 720                 725
gtt cgc cct tcc tac gtc ttg ggt ggc cgt ggc atg gag att gtc tac   3704
Val Arg Pro Ser Tyr Val Leu Gly Gly Arg Gly Met Glu Ile Val Tyr
730                 735                 740                 745
gat gag gct tcc ctc gag gat tac atc aac cgc gca act gag ttg tct   3752
Asp Glu Ala Ser Leu Glu Asp Tyr Ile Asn Arg Ala Thr Glu Leu Ser
                750                 755                 760
tct gac cac cca gtg ctg gtt gac cgc ttc ctg gac aac gct att gag   3800
Ser Asp His Pro Val Leu Val Asp Arg Phe Leu Asp Asn Ala Ile Glu
            765                 770                 775
atc gac gtc gac gca ctg tgc gac ggc gac gaa gtc tac ctg gcg ggc   3848
Ile Asp Val Asp Ala Leu Cys Asp Gly Asp Glu Val Tyr Leu Ala Gly
        780                 785                 790
gtc atg gaa cac atc gag gaa gcc ggc att cac tcc ggt gac tcc gca   3896
Val Met Glu His Ile Glu Glu Ala Gly Ile His Ser Gly Asp Ser Ala
    795                 800                 805
tgt gca ctt cct cca atg act ttg ggc gca cag gac atc gag aag gtc   3944
Cys Ala Leu Pro Pro Met Thr Leu Gly Ala Gln Asp Ile Glu Lys Val
810                 815                 820                 825
cgc gaa gca acc aag aag ctg gct ctg ggc atc ggc gta cag ggc ctg   3992
Arg Glu Ala Thr Lys Lys Leu Ala Leu Gly Ile Gly Val Gln Gly Leu
                830                 835                 840
atg aac gtc cag tac gca ctc aag gac gac atc ctc tac gtc atc gag   4040
Met Asn Val Gln Tyr Ala Leu Lys Asp Asp Ile Leu Tyr Val Ile Glu
            845                 850                 855
gca aac cca cgt gca tcc cgc acc gtg ccg ttc gtc tcc aag gca acg   4088
Ala Asn Pro Arg Ala Ser Arg Thr Val Pro Phe Val Ser Lys Ala Thr
        860                 865                 870
ggc gtc aac ctg gcc aag gca gca tcc cgt atc gca gtg ggc gcc acc   4136
Gly Val Asn Leu Ala Lys Ala Ala Ser Arg Ile Ala Val Gly Ala Thr
    875                 880                 885
atc aag gat ctc caa gat gag ggc atg att cct acc gag tac gac ggc   4184
Ile Lys Asp Leu Gln Asp Glu Gly Met Ile Pro Thr Glu Tyr Asp Gly
890                 895                 900                 905
ggc tcc ttg cca ctg gac gct cca atc gct gtg aag gaa gca gtg ttg   4232
```

Gly Ser Leu Pro Leu Asp Ala Pro Ile Ala Val Lys Glu Ala Val Leu
910 915 920
ccg ttc aac cgc ttc cgt cgc cca gat gga aag acc ctg gac acc ctg 4280
Pro Phe Asn Arg Phe Arg Arg Pro Asp Gly Lys Thr Leu Asp Thr Leu
925 930 935
ctt tcc cca gag atg aag tcc act ggc gag gtc atg ggc ttg gcc aac 4328
Leu Ser Pro Glu Met Lys Ser Thr Gly Glu Val Met Gly Leu Ala Asn
940 945 950
aac ttc ggc gct gca tat gca aag gct gaa gct ggc gcg ttt ggt gca 4376
Asn Phe Gly Ala Ala Tyr Ala Lys Ala Glu Ala Gly Ala Phe Gly Ala
955 960 965
ttg cca acc gaa ggc acc gtc ttc gtg acc gtg gct aac cgc gac aag 4424
Leu Pro Thr Glu Gly Thr Val Phe Val Thr Val Ala Asn Arg Asp Lys
970 975 980 985
cgc acc ctg atc ctg cca atc cag cgc ctg gcg tcg atg ggc tac aag 4472
Arg Thr Leu Ile Leu Pro Ile Gln Arg Leu Ala Ser Met Gly Tyr Lys
990 995 1000
atc ctc gcc acc gaa ggc acc gca ggc atg ctg cgc cgc aac ggc att 4520
Ile Leu Ala Thr Glu Gly Thr Ala Gly Met Leu Arg Arg Asn Gly Ile
1005 1010 1015
gat tgt gaa gtt gtg ctc aag gct tcc gac atc cgc gaa ggt gta gag 4568
Asp Cys Glu Val Val Leu Lys Ala Ser Asp Ile Arg Glu Gly Val Glu
1020 1025 1030
ggc aag tcc atc gtg gat cgt atc cgc gaa ggc gaa gtt gac ctc atc 4616
Gly Lys Ser Ile Val Asp Arg Ile Arg Glu Gly Glu Val Asp Leu Ile
1035 1040 1045
ctc aac acc cca gct ggt tct gct ggc gct cgc cac gat ggc tac gat 4664
Leu Asn Thr Pro Ala Gly Ser Ala Gly Ala Arg His Asp Gly Tyr Asp
1050 1055 1060 1065
atc cgc gca gca gca gtg acc gtg ggt gtt cca ctg atc acc act gtc 4712
Ile Arg Ala Ala Ala Val Thr Val Gly Val Pro Leu Ile Thr Thr Val
1070 1075 1080
cag ggt gtc acc gca gct gtc cag ggc att gag gcc ctg cgt gag ggc 4760
Gln Gly Val Thr Ala Ala Val Gln Gly Ile Glu Ala Leu Arg Glu Gly
1085 1090 1095
gtt gtc agc gtc cgc gcg ctg cag gaa ctc gac cac gca gtc aag gct 4808
Val Val Ser Val Arg Ala Leu Gln Glu Leu Asp His Ala Val Lys Ala
1100 1105 1110
taagccctat gacattcggc gagaagctt 4837

<210> 2

<211> 393
<212> PRT
<213> Brevibacterium lactofermentum

<400> 2

```
Val Ser Lys Asp Thr Thr Thr Tyr Gln Gly Val Thr Glu Ile Gly Ser
 1               5                  10                  15
Val Pro Ala Tyr Leu Val Leu Ala Asp Gly Arg Thr Phe Thr Gly Phe
            20                  25                  30
Gly Phe Gly Ala Ile Gly Thr Thr Leu Gly Glu Ala Val Phe Thr Thr
        35                  40                  45
Ala Met Thr Gly Tyr Gln Glu Thr Met Thr Asp Pro Ser Tyr His Arg
    50                  55                  60
Gln Ile Val Val Ala Thr Ala Pro Gln Ile Gly Asn Thr Gly Trp Asn
 65                 70                  75                  80
Asp Glu Asp Asn Glu Ser Arg Asp Gly Lys Ile Trp Val Ala Gly Leu
                85                  90                  95
Val Ile Arg Asp Leu Ala Ala Arg Val Ser Asn Trp Arg Ala Thr Thr
            100                 105                 110
Ser Leu Gln Gln Glu Met Ala Asp Gln Gly Ile Val Gly Ile Gly Gly
        115                 120                 125
Ile Asp Thr Arg Ala Leu Val Arg His Leu Arg Asn Glu Gly Ser Ile
    130                 135                 140
Ala Ala Gly Ile Phe Ser Gly Ala Asp Ala Gln Arg Pro Val Glu Glu
145                 150                 155                 160
Leu Val Glu Ile Val Lys Asn Gln Pro Ala Met Thr Gly Ala Asn Leu
                165                 170                 175
Ser Val Glu Val Ser Ala Asp Glu Thr Tyr Val Ile Glu Ala Glu Gly
            180                 185                 190
Glu Glu Arg His Thr Val Val Ala Tyr Asp Leu Gly Ile Lys Gln Asn
        195                 200                 205
Thr Pro Arg Arg Phe Ser Ala Arg Gly Val Arg Thr Val Ile Val Pro
    210                 215                 220
Ala Glu Thr Pro Leu Glu Asp Ile Lys Gln Tyr Asn Pro Ser Gly Val
225                 230                 235                 240
Phe Ile Ser Asn Gly Pro Gly Asp Pro Ala Ala Ala Asp Val Met Val
                245                 250                 255
Asp Ile Val Arg Glu Val Leu Glu Ala Asp Ile Pro Phe Phe Gly Ile
            260                 265                 270
Cys Phe Gly Asn Gln Ile Leu Gly Arg Ala Phe Gly Met Glu Thr Tyr
        275                 280                 285
```

```
Lys Leu Lys Phe Gly His Arg Gly Ile Asn Val Pro Val Lys Asn His
    290                 295                 300
Ile Thr Gly Lys Ile Asp Ile Thr Ala Gln Asn His Gly Phe Ala Leu
305                 310                 315                 320
Lys Gly Glu Ala Gly Gln Glu Phe Glu Thr Asp Phe Gly Thr Ala Ile
                325                 330                 335
Val Thr His Thr Cys Leu Asn Asp Gly Val Val Glu Gly Val Ala Leu
            340                 345                 350
Lys Ser Gly Arg Ala Tyr Ser Val Gln Tyr His Pro Glu Ala Ala Ala
        355                 360                 365
Gly Pro Asn Asp Ala Ser Pro Leu Phe Asp Gln Phe Val Glu Leu Met
    370                 375                 380
Asp Ala Asp Ala Gln Lys Lys Gly Ala
385                 390
```

<210> 3
<211> 1113
<212> PRT
<213> Brevibacterium lactofermentum

<400> 3

```
Met Pro Lys Arg Ser Asp Ile Asn His Val Leu Val Ile Gly Ser Gly
  1               5                  10                  15
Pro Ile Val Ile Gly Gln Ala Cys Glu Phe Asp Tyr Ser Gly Thr Gln
            20                  25                  30
Ala Cys Arg Val Leu Lys Glu Glu Gly Leu Arg Val Thr Leu Ile Asn
        35                  40                  45
Ser Asn Pro Ala Thr Ile Met Thr Asp Pro Glu Met Ala Asp His Thr
    50                  55                  60
Tyr Val Glu Pro Ile Glu Pro Glu Tyr Ile Asp Lys Ile Phe Ala Lys
65                  70                  75                  80
Glu Ile Glu Gln Gly His Pro Ile Asp Ala Val Leu Ala Thr Leu Gly
                85                  90                  95
Gly Gln Thr Ala Leu Asn Ala Ala Ile Gln Leu Asp Arg Leu Gly Ile
            100                 105                 110
Leu Glu Lys Tyr Gly Val Glu Leu Ile Gly Ala Asp Ile Asp Ala Ile
        115                 120                 125
Glu Arg Gly Glu Asp Arg Gln Lys Phe Lys Asp Ile Val Thr Thr Ile
    130                 135                 140
Gly Gly Glu Ser Ala Arg Ser Arg Val Cys His Asn Met Asp Glu Val
145                 150                 155                 160
```

His Glu Thr Val Ala Glu Leu Gly Leu Pro Val Val Val Arg Pro Ser
165 170 175
Phe Thr Met Gly Gly Leu Gly Ser Gly Leu Ala Tyr Asn Thr Glu Asp
180 185 190
Leu Glu Arg Ile Ala Gly Gly Gly Leu Ala Ala Ser Pro Glu Ala Asn
195 200 205
Val Leu Ile Glu Glu Ser Ile Leu Gly Trp Lys Glu Phe Glu Leu Glu
210 215 220
Leu Met Arg Asp Thr Ala Asp Asn Val Val Val Ile Cys Ser Ile Glu
225 230 235 240
Asn Val Asp Ala Leu Gly Val His Thr Gly Asp Ser Val Thr Val Ala
245 250 255
Pro Ala Leu Thr Leu Thr Asp Arg Glu Phe Gln Lys Met Arg Asp Gln
260 265 270
Gly Ile Ala Ile Ile Arg Glu Val Gly Val Asp Thr Gly Gly Cys Asn
275 280 285
Ile Gln Phe Ala Ile Asn Pro Val Asp Gly Arg Ile Ile Thr Ile Glu
290 295 300
Met Asn Pro Arg Val Ser Arg Ser Ser Ala Leu Ala Ser Lys Ala Thr
305 310 315 320
Gly Phe Pro Ile Ala Lys Met Ala Ala Lys Leu Ala Ile Gly Tyr Thr
325 330 335
Leu Asp Glu Ile Thr Asn Asp Ile Thr Gly Glu Thr Pro Ala Ala Phe
340 345 350
Glu Pro Thr Ile Asp Tyr Val Val Val Lys Ala Pro Arg Phe Ala Phe
355 360 365
Glu Lys Phe Val Gly Ala Asp Asp Thr Leu Thr Thr Thr Met Lys Ser
370 375 380
Val Gly Glu Val Met Ser Leu Gly Arg Asn Tyr Ile Ala Ala Leu Asn
385 390 395 400
Lys Ala Leu Arg Ser Leu Glu Thr Lys Gln Gln Gly Phe Trp Thr Lys
405 410 415
Pro Asp Glu Phe Phe Ala Gly Glu Arg Ala Thr Asp Lys Ala Ala Val
420 425 430
Leu Glu Asp Leu Lys Arg Pro Thr Glu Gly Arg Leu Tyr Asp Val Glu
435 440 445
Leu Ala Met Arg Leu Gly Ala Ser Val Glu Glu Leu Tyr Glu Ala Ser
450 455 460
Ser Ile Asp Pro Trp Phe Leu Ala Glu Leu Glu Ala Leu Val Gln Phe
465 470 475 480
Arg Gln Lys Leu Val Asp Ala Pro Phe Leu Asn Glu Asp Leu Leu Arg

```
                485                 490                 495
Glu Ala Lys Phe Met Gly Leu Ser Asp Leu Gln Ile Ala Ala Leu Arg
            500                 505                 510
Pro Glu Phe Ala Gly Glu Asp Gly Val Arg Thr Leu Arg Leu Ser Leu
        515                 520                 525
Gly Ile Arg Pro Val Phe Lys Thr Val Asp Thr Cys Ala Ala Glu Phe
    530                 535                 540
Glu Ala Lys Thr Pro Tyr His Tyr Ser Ala Tyr Glu Leu Asp Pro Ala
545                 550                 555                 560
Ala Glu Ser Glu Val Ala Pro Gln Thr Glu Arg Glu Lys Val Leu Ile
                565                 570                 575
Leu Gly Ser Gly Pro Asn Arg Ile Gly Gln Gly Ile Glu Phe Asp Tyr
            580                 585                 590
Ser Cys Val His Ala Ala Leu Glu Leu Ser Arg Val Gly Tyr Glu Thr
        595                 600                 605
Val Met Val Asn Cys Asn Pro Glu Thr Val Ser Thr Asp Tyr Asp Thr
    610                 615                 620
Ala Asp Arg Leu Tyr Phe Glu Pro Leu Thr Phe Glu Asp Val Met Glu
625                 630                 635                 640
Val Tyr His Ala Glu Ala Gln Ser Gly Thr Val Ala Gly Val Ile Val
                645                 650                 655
Gln Leu Gly Gly Gln Thr Pro Leu Gly Leu Ala Asp Arg Leu Lys Lys
            660                 665                 670
Ala Gly Val Pro Val Ile Gly Thr Ser Pro Glu Ala Ile Asp Met Ala
        675                 680                 685
Glu Asp Arg Gly Glu Phe Gly Ala Leu Leu Asn Arg Glu Gln Leu Pro
    690                 695                 700
Ala Pro Ala Phe Gly Thr Ala Thr Ser Phe Glu Glu Ala Arg Thr Val
705                 710                 715                 720
Ala Asp Glu Ile Ser Tyr Pro Val Leu Val Arg Pro Ser Tyr Val Leu
                725                 730                 735
Gly Gly Arg Gly Met Glu Ile Val Tyr Asp Glu Ala Ser Leu Glu Asp
            740                 745                 750
Tyr Ile Asn Arg Ala Thr Glu Leu Ser Ser Asp His Pro Val Leu Val
        755                 760                 765
Asp Arg Phe Leu Asp Asn Ala Ile Glu Ile Asp Val Asp Ala Leu Cys
    770                 775                 780
Asp Gly Asp Glu Val Tyr Leu Ala Gly Val Met Glu His Ile Glu Glu
785                 790                 795                 800
Ala Gly Ile His Ser Gly Asp Ser Ala Cys Ala Leu Pro Pro Met Thr
                805                 810                 815
```

Leu Gly Ala Gln Asp Ile Glu Lys Val Arg Glu Ala Thr Lys Lys Leu
820 825 830
Ala Leu Gly Ile Gly Val Gln Gly Leu Met Asn Val Gln Tyr Ala Leu
835 840 845
Lys Asp Asp Ile Leu Tyr Val Ile Glu Ala Asn Pro Arg Ala Ser Arg
850 855 860
Thr Val Pro Phe Val Ser Lys Ala Thr Gly Val Asn Leu Ala Lys Ala
865 870 875 880
Ala Ser Arg Ile Ala Val Gly Ala Thr Ile Lys Asp Leu Gln Asp Glu
885 890 895
Gly Met Ile Pro Thr Glu Tyr Asp Gly Gly Ser Leu Pro Leu Asp Ala
900 905 910
Pro Ile Ala Val Lys Glu Ala Val Leu Pro Phe Asn Arg Phe Arg Arg
915 920 925
Pro Asp Gly Lys Thr Leu Asp Thr Leu Leu Ser Pro Glu Met Lys Ser
930 935 940
Thr Gly Glu Val Met Gly Leu Ala Asn Asn Phe Gly Ala Ala Tyr Ala
945 950 955 960
Lys Ala Glu Ala Gly Ala Phe Gly Ala Leu Pro Thr Glu Gly Thr Val
965 970 975
Phe Val Thr Val Ala Asn Arg Asp Lys Arg Thr Leu Ile Leu Pro Ile
980 985 990
Gln Arg Leu Ala Ser Met Gly Tyr Lys Ile Leu Ala Thr Glu Gly Thr
995 1000 1005
Ala Gly Met Leu Arg Arg Asn Gly Ile Asp Cys Glu Val Val Leu Lys
1010 1015 1020
Ala Ser Asp Ile Arg Glu Gly Val Glu Gly Lys Ser Ile Val Asp Arg
1025 1030 1035 1040
Ile Arg Glu Gly Glu Val Asp Leu Ile Leu Asn Thr Pro Ala Gly Ser
1045 1050 1055
Ala Gly Ala Arg His Asp Gly Tyr Asp Ile Arg Ala Ala Ala Val Thr
1060 1065 1070
Val Gly Val Pro Leu Ile Thr Thr Val Gln Gly Val Thr Ala Ala Val
1075 1080 1085
Gln Gly Ile Glu Ala Leu Arg Glu Gly Val Val Ser Val Arg Ala Leu
1090 1095 1100
Gln Glu Leu Asp His Ala Val Lys Ala
1105 1110

<210> 4
<211> 32

<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:primer for amplifying kanamycin resistant gene of Streptococcus faecalis

<400> 4
cccgttaact gcttgaaacc caggacaata ac 32

<210> 5
<211> 30
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:primer for amplifying kanamycin resistant gene of Streptococcus faecalis

<400> 5
cccgttaaca tgtacttcag aaaagattag 30

<210> 6
<211> 26
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:primer for amplifying Escherichia coli cloning vector pHSG399

<400> 6
gatatctacg tgccgatcaa cgtctc 26

<210> 7
<211> 25
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:primer for amplifying Escherichia coli cloning vector pHSG399

<400> 7
aggccttttt ttaaggcagt tattg 25